

Simple but precise and effective

Compact sensor solution ensures high quality in manual production

It doesn't always have to be highly complex technology that is at the heart of an interesting application. The best example of this is an automotive supplier that used a simple but very effective sensor solution on a manually operated punch to implement a manufacturing process with zero error tolerance.

Bade und Rinscheid Metallwarenfabrik GmbH (BARI) is a manufacturer of formed parts, primarily for the automotive industry. "Hardly any car or truck is on the road today without one of our products. We manufacture precision stamped parts mainly from aluminum, stainless steel and spring steels in large series, with our core competencies lying in forming technology for applications in the electronics sector, in cable routing and in the integration of metals in intelligent solutions for vibration and noise reduction," says Christian Dröge, Technical Foreman at BARI, describing the manufacturing spectrum of the company based in Olpe (South Sauerland).

Tool developed for manual production

One of BARI's most recent orders involves the production of a sheet steel part to hold printed circuit boards for a navigation system. This requires so-called stud bolts to be pressed in from the underside of the component. With the expected annual quantity, Christian Dröge believes that it is not worth investing in a more complex automation solution for pressing in the studs: "We have therefore developed a tool for this task with one of our suppliers, which is used on a manually operated punch. In one part of the tool, a total of seven bolts have to be inserted by hand before the pressing process."



From the left: Top and bottom of the component into which the stud bolts for holding a printed circuit board were pressed.

Solution sought for reliable production

Manual activities always harbor the risk of faulty processes, as the technical foreman knows all too well: "When inserting the bolts, there is of course the problem that a rivet could be forgotten and thus rejects produced. During the search for a sensor solution that guarantees safe, reliable manual production, we therefore consulted ipf electronic." A good decision, as it turned out, because after an initial practical test on site, the application specialist from Altena was very quickly able to present the company with a simple but very effective solution. The key components of this solution are the optical sensors **OTQ40173**, an RGB signal light (AO000458) and a distribution terminal that can logically operate the input signals from the optical sensors.



The light color of the signal light changes to "green" as soon as the light receives the logic operation AND signals from the optical sensors. All bolts are then present in the tool and can be pressed into the component.

Optical "tiny" for confined installation spaces

The optical sensors in the **OTQ4** series are extremely compact, rod-shaped devices with protection class IP65, which are particularly recommended for applications where space is very limited, i.e. they can also be used in areas that were previously mainly reserved for photoconductive optics. The start-up of these sensors, which work with visible LED red light, is extremely simple, as the alignment and setting of the devices is greatly simplified by the clearly visible light spot.

To detect the stud bolts inserted by hand, seven optical diffuse reflection sensors were mounted at different positions on the relevant tool part in such a way that the operator can work unhindered on the punch. In this specific application, the diffuse reflection sensors have a sensing range of 50mm with a light spot size of 2mm and a switching frequency of 1kHz. As the devices have a background suppression along with their compact dimensions, the sensors work with a precisely defined range regardless of the reflective properties of the object surfaces (color, gloss, structure). This ensures that only the desired objects are detected and any components behind them are reliably blanked out.

Logic links switching signals for RGB light

Once all the bolts have been inserted into the tool as required, they are reliably detected by the optical diffuse reflection sensors, with each device generating an output signal. The further task was to visualize this information (all bolts present) as simply as possible and without automation effort. In order to generate a common signal from the individual sensor information, all sensor signals were linked via a distribution terminal in which all inputs are internally AND-linked. This means that the distribution terminal only generates an output switching signal if all input signals are present at the same time. As the distributor island has eight inputs, but only seven sensor signals are to be linked in the application, the free input or slot was provided with a so-called jumper, which virtually simulates the missing input information.

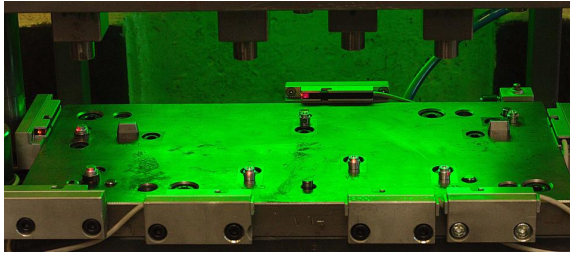
The output or sum signal of the distribution terminal is used to control a change-over contact that supplies +24V to two different signal inputs of the RGB signal light, depending on the switching state. The light is ultimately used to signal to the system operator whether or not all bolts have been inserted in the tool. As the economical light (power consumption max. 8W) with degree of protection IP54 has an angle of emitted beam of 120° and the LED light is very bright, it could be installed in the rear area of the punch, above the tool, so as not to obstruct the activities on the machine in any way. Christian Dröge summarizes the function of the solution: "If the tool is not yet equipped with bolts, the RGB light is permanently lit up "red". This is its permanent state, so to speak. The light color only changes to "green" when 24V is applied to the corresponding light input via the relay. To do this, the relay must be activated via the output of the distributor island, which only happens when all optical sensors detect a bolt at the same time. This means that when the light is green, all studs are inserted in the tool and can be pressed with the subsequently placed component." However, if a stud is forgotten, the linked logic operation of the distributor island is not present. In this case, the signal light is wired to another control input and lights up "red".



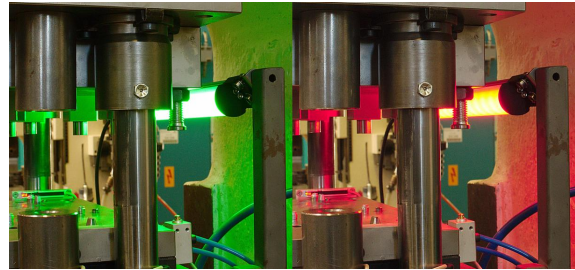
The sensors in the OTQ4 series are just the size of two matches lying on top of each other.



The RGB signal light on the tool cannot be overlooked.



As the sensors work with visible LED red light, installation is very simple.



The RGB signal light was installed in the rear area of the punch, above the tool.

Extremely reliable process

"If just a single rivet is missing in the tool, the employee at the punch recognizes this instantaneously because the signal cannot be overlooked. In this way, we achieve an extremely reliable manual production process and specifically avoid operating errors," explains Christian Dröge and emphasizes: "The solution is relatively simple, but very effective. I was particularly impressed by the very compact design of the sensors, where one device is just the thickness of two matches placed on top of each other. This made it very easy to integrate the sensors into the mold."

BARI was already able to test the sensor solution extensively during the pre-series production of the new product, with success. "We produced around 500 parts on the punch during this time, and without any errors," says Dröge.



Christian Dröge, Technical Foreman at Bade und Rinscheid Metallwarenfabrik: "I was particularly impressed by the compact design of the sensors and the easy-to-implement concept of the overall solution."